PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : D21F 3/02 | A1

(11) International Publication Number: **WO 00/34570**

(43) International Publication Date: 15 June 2000 (15.06.00)

(21) International Application Number: PCT/SE99/02228

(22) International Filing Date: 30 November 1999 (30.11.99)

(30) Priority Data:

9804231-0	7 December 1998 (07.12.98)	SE
9903694-9	14 October 1999 (14.10.99)	SE

(71) Applicant *(for all designated States except US)*: VALMET-KARLSTAD AB [SE/SE]; Box 1014, S-651 15 Karlstad (SE).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: LEANDERSSON, Per, Anders, Artur [SE/SE]; Kvarnbergsgatan 6, S-652 29 Karlstad (SE). SALOMONSSON, Carl-Gustaf [SE/SE]; Prästbolsvägen 8, S-665 95 Fagerås (SE).

(74) Agent: LUNDQUIST, Lars-Olof; L-O Lundquist Patentbyrå AB, P.O. Box 80, S-651 03 Karlstad (SE).

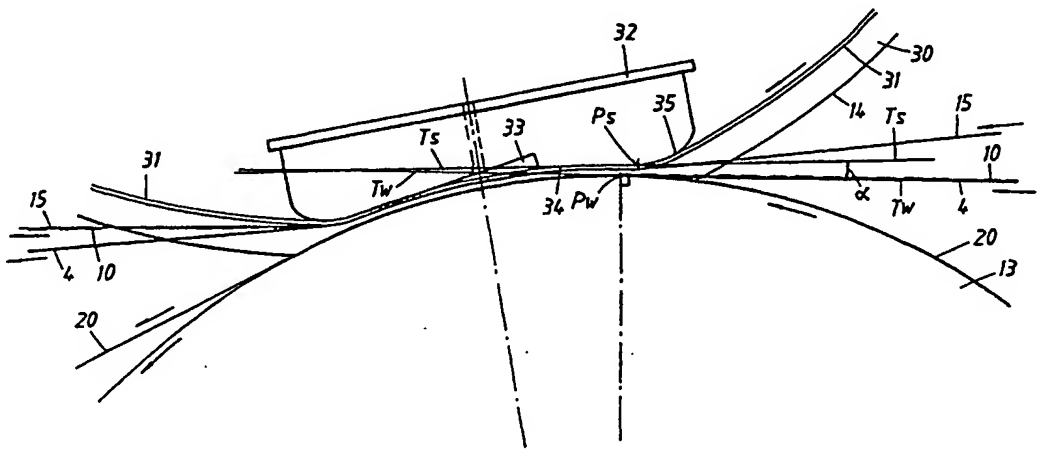
(81) Designated States: BR, CA, JP, KR, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published

With international search report.

Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: SHOE PRESS IN A WIRE PART OF A BOARD OR PAPER MACHINE AND A WIRE PART



(57) Abstract

A shoe press in a wire part with headbox and forming wire (4), which shoe press comprises a shoe press roll (14) outside and a counter roll (13) inside the loop of the forming wire, and an outer clothing (15) running outside the forming wire to transfer the web (10) after the extended press nip to a press section, which shoe press roll has a press shoe (32) with a curved, convex inlet surface (35) and a concave press surface (34) into which the inlet surface transits in a point (Ps) intersected by a tangent (Ts) to the inlet surface, whereby the forming wire encounters the counter roll in a point (Pw) intersected by a tangent (Tw) to the counter roll, and wherein the shoe press has an inner belt (20) running in the loop of the forming wire and having water-receiving voids that are open towards the forming wire. In accordance with the invention the press shoe is so arranged in relation to said point (Pw) that said tangent (Ts) and said tangent (Tw) intersect each other at an acute angle α that is greater than 2°. The invention also relates to a wire part having such a shoe press.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania
AM	Armenia
AT	Austria
AU	Australia
AZ	Azerbaijan
BA	Bosnia and Herzegovina
BB	Barbados
BE	Belgium
BF	Burkina Faso
BG	Bulgaria
BJ	Benin
BR	Brazil
BY	Belarus
CA	Canada
CF	Central African Republic
CG	Congo
CH	Switzerland
CI	Côte d'Ivoire
CM	Cameroon
CN	China
CU	Cuba
CZ	Czech Republic
DE	Germany
DK	Denmark
EE	Estonia
ES	Spain
FI	Finland
FR	France
GA	Gabon
GB	United Kingdom
GE	Georgia
GH	Ghana
GN	Guinea
GR	Greece
HU	Hungary
IE	Ireland
IL	Israel
IS	Iceland
IT	Italy
JP	Japan
KE	Kenya
KG	Kyrgyzstan
KP	Democratic People's Republic of Korea
KR	Republic of Korea
KZ	Kazakstan
LC	Saint Lucia
LI	Liechtenstein
LK	Sri Lanka
LR	Liberia
LS	Lesotho
LT	Lithuania
LU	Luxembourg
LV	Latvia
MC	Monaco
MD	Republic of Moldova
MG	Madagascar
MK	The former Yugoslav Republic of Macedonia
ML	Mali
MN	Mongolia
MR	Mauritania
MW	Malawi
MX	Mexico
NE	Niger
NL	Netherlands
NO	Norway
NZ	New Zealand
PL	Poland
PT	Portugal
RO	Romania
RU	Russian Federation
SD	Sudan
SE	Sweden
SG	Singapore
SI	Slovenia
SK	Slovakia
SN	Senegal
SZ	Swaziland
TD	Chad
TG	Togo
TJ	Tajikistan
TM	Turkmenistan
TR	Turkey
TT	Trinidad and Tobago
UA	Ukraine
UG	Uganda
US	United States of America
UZ	Uzbekistan
VN	Viet Nam
YU	Yugoslavia
ZW	Zimbabwe

Shoe press in a wire part of a board or paper machine and a wire part

The present invention relates to a shoe press in a wire part of a board or paper machine for manufacturing a continuous web, which wire part comprises a headbox and at least one forming wire running in a loop, which shoe press comprises a shoe press roll arranged outside the loop of the forming wire, a counter roll arranged in the loop of the forming wire and, together with the shoe press roll, forming an extended press nip, and an outer clothing running in a loop outside the forming wire through said press nip to carry and transfer the web after the press nip to a subsequent press section, which shoe press roll comprises a rotatably journalled, flexible shoe belt and a press shoe arranged on the inside of the shoe belt and having a curved, convex inlet surface and a concave press surface for cooperation with the counter roll, the transition between the inlet surface and the press surface being in a point Ps intersected by a tangent Ts to the inlet surface, whereby the forming wire encounters the counter roll in a point Pw intersected by a tangent Tw to the curved envelope surface of the counter roll, which tangent Tw coincides with the draw of the forming wire upstream of said point Pw, and wherein the shoe press comprises at least one water-receiving member arranged in the loop of the forming wire in connection to the press nip, and has water-receiving, uniformly distributed voids that are open at least in the direction of the side of the forming wire not carrying the web.

The invention also relates to a wire part of a board or paper machine for manufacturing a continuous web, which wire part comprises a headbox, at least one forming wire running in a loop, and one or more presses, at least one of which is a shoe press, which shoe press comprises a

shoe press roll arranged outside the loop of the forming wire, a counter roll arranged in the loop of the forming wire and, together with the shoe press roll, forming an extended press nip, and an outer clothing running in a loop outside the forming wire through said press nip to carry and transfer the web after the press nip to a subsequent press section, which shoe press roll comprises a rotatably journalled, flexible shoe belt and a press shoe arranged on the inside of the shoe belt and having a curved, convex inlet surface and a concave press surface for cooperation with the counter roll, the transition between the inlet surface and the press surface being in a point Ps intersected by a tangent Ts to the inlet surface, whereby the forming wire encounters the counter roll in a point Pw intersected by a tangent Tw to the curved envelope surface of the counter roll, which tangent Tw coincides with the draw of the forming wire upstream of said point Pw, and wherein the shoe press comprises at least one water-receiving member arranged in the loop of the forming wire close to the press nip, and has water-receiving, uniformly distributed voids that are open at least in the direction of the side of the forming wire not carrying the web.

The web produced on the forming wire has a low dry-solids content, typically between 10 and 20 per cent, and is therefor sensitive to external strain. Such external strain occurs when the forming wire runs towards and is bent over a larger or smaller portion of the curved inlet surface of the shoe, resulting in damage to the wet web. It has also been found that the shoe belt immediately prior to the press nip does not follow the circle arc it has in rest position, but instead bulges out just before and/or within the inlet radius of the curved shoe due to its rigidity. This deflection affects the adjacent process belt so that it is pressed down into the wet paper web. The paper web is subjected to shearing damage

due to the low dry-solids content of the paper web, in combination with the difference in speed that arises between the forming wire and the process belt when the shoe belt is deflected in the manner described.

When the web is pressed in a press nip at the end of a wire part, large quantities of water are released, as the dry-solids content of the web is very low, as mentioned typically between 10 and 20 per cent. Part of the water volume can be accumulated in the open volume of the forming wire, formed by its voids. When the forming wire reaches the press nip, however, these voids are already filled with water to a greater or lesser extent from the draining of the web along the preceding forming zone. Considerable difficulties are therefore encountered in controlling the volume available in the forming wire to receive the water pressed out of the web in the press nip.

When using one press felt or two press felts in a single-felted or double-felted press nip, respectively, the press felt will absorb part of the released quantity of water. However, the absorbing capacity of the press felt diminishes after a relatively short period of use as it is clogged by small fibres that accompany the water pressed out in the press nip and deposited on the surface of the press felt as well as penetrating it. Even if the press felt has some elasticity in its thickness direction, this elasticity is exhausted because of the continuous compression to which the press felt is subjected in the press nip so that the thickness of the press felt decreases, which results in reduced absorption capacity. Continuous conditioning of the press felt is therefore also more difficult. If the press nip is single-felted and the clothing in contact with the web is an impermeable belt, the strain on the press felt is increased. The use of suction equipment to create a

suction zone in the press nip to remove the water pressed out also entails disadvantages as explained below. The difficulties to remove water increase as running speeds increase. At the same time demands are constantly made by industry for higher running speeds. It would be possible to produce a wire for direct web contact with a greater open volume than presently existing forming wires. Such a solution is not available, however, when taking into account that the wire is designed to serve not only as a press clothing in the pre-press but also as a forming wire, it being important that the fibres are retained on the forming wire and do not accompany the drainage water and that the forming wire does not carry with it excessive quantities of water after the press nip, which water is physically retained in said imagined greater open volume and burdens the forming wire in an undesirable way.

WO 97/13030 describes a wire part with a pre-press, having a press nip, through which a forming wire passes together with an impermeable transfer belt. The press nip is formed by a press shoe roll and a press roll that has an envelope surface provided with openings (Figure 2, page 11, second paragraph). The transfer belt carries the web on its underside from the press nip to the clothing of a subsequent shoe press. This publication does not discuss dealing with the water pressed out of the web in a shoe press nip or the capacity of the perforated press roll. Neither does it mention anything about the shearing damage that occurs in the inlet part of the shoe press nip or just prior to this. The publication therefore proposes no solution to this problem.

The object of the invention is to provide a shoe press that makes it possible to prevent damages to the wet and therefore sensitive web, in an efficient and controllable manner.

The shoe press and the wire part in accordance with the invention are characterized in that the press shoe is so arranged in relation to said point Pw that said tangent Ts and said tangent Tw intersect each other at an acute angle α that is greater than 2°, preferably greater than 6°.

The invention will be further described with reference to the drawings, in which

Figure 1 is a side view of parts of a paper machine with a shoe press in accordance with a first embodiment.

Figure 2 is a cut-out section of a water-receiving belt in the shoe press in accordance with Figure 1.

Figure 3 is a side view of parts of a paper machine with a shoe press in accordance with a second embodiment.

Figure 4 is a side view of parts of a paper machine with a shoe press in accordance with a third embodiment.

Figure 5 shows parts of the shoe press substantially in accordance with Figure 1, with the shoe mounted in a specific position in relation to the point where the forming wire meets the counter roll.

Figure 6 shows the shoe press in accordance with Figure 5 with the shoe mounted in a different position.

Figure 1 shows, schematically, parts of a paper machine comprising a wet section 1 and a press section 2. The wet section 1 comprises a wire part which in the embodiment shown consists of a fourdrinier former, comprising a headbox 3 and a forming wire 4, running in an endless loop around a plurality of guide rolls, which comprise a

breast roll 5, a wire turning roll 6, a wire roll 7, an alignment roll 8 and a tension roll 9. Stock is ejected from the headbox 3 onto the forming wire 4 and dewatered to form a continuous web 10. At the end of the fourdrinier former, a plurality of dry suction boxes 11 are arranged in the loop of the forming wire 4. However, any type of wire part may be used, e.g. a twin wire part with a forming roll.

The fourdrinier former further comprises a shoe press 12, which constitutes a pre-press, and which is arranged downstream of the dry suction boxes 11. The shoe press 12 comprises a shoe press roll and a counter roll 13. The counter roll 13 is arranged in the loop of the forming wire 4, while the shoe press roll 14 is arranged outside the loop of the forming wire 4. The counter roll 13 and shoe press roll 14 co-operate with each other to form an extended press nip between them. The forming wire 4 runs through the press nip, whilst encompassing a pre-determined sector part of the counter roll 13. Further, the shoe press 12 comprises an outer impermeable belt 15, running in an endless loop around a plurality of guide rolls 16 and through the press nip whilst encompassing a pre-determined sector angle of the shoe press roll 14. The impermeable belt 15 co-operates with a lower press felt 17 of a subsequent shoe press 18 in the press section 2, which shoe press 18 also has an upper press felt 19. The impermeable belt 15 has a smooth surface, which faces the forming wire 4 and to which the formed web 10 adheres after the web 10 has passed the press nip.

The shoe press 12 further comprises a first water-receiving member 20 in the form of a non-compressible inner belt, running in a loop inside the loop of the forming wire 4 around a plurality of guide rolls 21 and around the counter roll 13 and three of the guide rolls of the forming wire 4. In the embodiment shown in

Figure 1, the belt 20 is guided directly onto the counter roll to meet the forming wire in or shortly before the extended press nip, where the forming wire 4 reaches the counter roll 13. The belt 20 is driven around in its loop by its friction engagement with the forming wire and the counter roll in the press nip.

The belt 20 has water-receiving voids 22, open towards the outside of the belt 20, which outside, in the extended press nip, is in contact with the side of the forming wire 4 not carrying the web. The water-receiving voids 22 are visible to the naked eye and are evenly distributed in the longitudinal and transverse directions of the belt 20 in such a way that the water-receiving capacity is uniform or virtually uniform per unit of area along and across the belt 20. In one embodiment of the belt 20, the voids 22 are also open towards the inside of the belt, which inside, in the extended press nip, is in contact with the envelope surface of the counter roll. In other words, the voids 22 form through-openings in the thickness direction of the belt 20. A preferred embodiment of such a belt is a wire, in which the through-openings are defined by the intersecting threads 23, 24 of the wire, see Figure 2.

In another embodiment (not shown), the belt 20 has straight, uniform through-holes which give the belt a perforated appearance.

In a third embodiment (not shown), the belt has recesses on its outer side facing the forming wire, which recesses are preferably as deep as possible and have any shape, for instance round depressions and/or long grooves that are longitudinal, transverse or diagonal or which cross each other.

In a fourth embodiment (not shown), the belt 20 has voids 22 that consist of a combination of said second and third embodiments.

The belt 20 is thus either permeable or impermeable to water.

The thickness of the belt 20 and the design and number of the voids 22 per unit of area are chosen in such a way that the belt obtains an open volume equal to or substantially equal to or greater than the volume of water pressed out of the web in the press nip, for instance 1-100 per cent greater. To be able to ensure a constant open volume during an extended period of production it is consequently necessary that the belt is not compressed in the press nip so that its thickness is diminished. For a wire with suitable thickness and thread dimensions, the water-receiving capacity can be in the range 300-2,000 g/m^2 and may normally be 800-1,300 g/m^2 (corresponding to a void volume of 300-2,000 cm^3/m^2 and 800-1,300 cm^3/m^2, respectively).

To ensure continuous operation with sustained removal of a constant quantity of water from the press nip and to be able to control this removal, it is important that the press also comprises conditioning members arranged at suitable locations downstream of the press nip for continuous removal of water from the voids 22 of the belt 20, so that the belt is dry and free of fibres when it runs into the press nip. In the embodiment shown, such conditioning members comprise a high-pressure squirter 25 for air and two suction boxes 26. One or both of the suction boxes can be replaced by at least one blow box.

Figure 3 shows parts of a shoe press in accordance with a second embodiment of the invention. The shoe press in Figure 3 is similar to the one in Figure 1 but comprises,

additionally, a second water-receiving member in the form of an open counter roll 13, the shell of which has water-receiving, evenly distributed voids 27. The embodiment shown in Figure 3 uses a perforated counter roll 13, said voids 27 of which constitute radially extending openings. The water that runs through the openings 27 is collected in an inner trough 28, from which the water is drained through one of the end walls of the counter roll. When using an open counter roll 13, the water-receiving belt 20 is always permeable. Alternatively, the open counter roll 13 may be a blind-drilled or grooved counter roll, which thus has water-receiving voids that are outwardly open but inwardly closed. When using an open counter roll 13, its voids 27 and the voids 22 of the belt 20 together have an aggregate open volume equal to or substantially equal to or greater than the volume of water pressed out of the web in the press nip. In this context, it is suitable for the voids 22 of the belt 20 to constitute at least 50 per cent, preferably at least 60 per cent, of said aggregate open volume. It is also suitable to arrange some form of conditioning member by the open counter roll 13, when this helps in handling the press water.

Figure 4 shows parts of a shoe press 12 in accordance with a third embodiment. The shoe press in Figure 4 resembles that in Figure 3 but has only one water-receiving member, namely in the form of an open counter roll 13, the shell of which has water-receiving, evenly distributed voids 27. A perforated counter roll 13 is used in the embodiment shown in Figure 4, the voids 27 of the counter roll forming radially extending through-openings. The water that runs through the openings 27 is collected in an inner trough 28, from which the water is drained through one of the end walls of the counter roll. Alternatively, the open counter roll 13 may be a blind-drilled or grooved counter roll, which

thus has water-receiving voids that are outwardly open but inwardly closed. When using an open counter roll 13, its voids 27 have an aggregate open volume equal to or substantially equal to or greater than the volume of water pressed out of the web in the press nip. It is suitable to arrange some form of conditioning member by the open counter roll 13.

To achieve the best results as regards the handling of the press water, it is necessary that the open volume available in a wire or, alternatively, in a wire and an open counter roll, or only an open counter, is essentially greater than, e.g. 50-100% greater, than the volume of water pressed out of the web. This is presumably due to the time being so limited that accessibility to the open volume must be good. This also means that the open volume must be evenly distributed over the surface.

Figures 5 and 6 show parts of the shoe press 12 substantially in accordance with Figure 1 within the area for the extended nip. The shoe press roll 14 has two rotatably journalled end walls 30, a flexible shoe belt 31 fitted to the end walls and forming the shell of the shoe press roll, and a press shoe 32 which is arranged on the inside of the shoe belt 31 and which, together with the counter roll 13 defines the extended press nip. The press shoe 32 is provided with a plurality of hydrostatic pressure pockets 33 arranged in a row side by side. The press shoe 32 has a concave press surface 34 and a convex, curved inlet surface 35 which transits into the concave press surface 34 in a point Ps intersected by a tangent Ts to the curved inlet surface 35.

The forming wire 4 meets the counter roll 13 in a point Pw intersected by a tangent Tw to the curved envelope

surface of the counter roll, which tangent Tw coincides with the forming wire 4 upstream of said point Pw.

The two tangents Ts and Tw intersect each other at an acute angle α that is greater than 2°. At this lower limit value the point Pw is situated downstream of the point Ps and considerably closer to this point Ps than the front end of the pressure pocket, as is clear from Figure 5. At increasing values of the angle α the point Pw approaches the point Ps of the shoe, and passes this point when the angle α is increased further, so that the point Pw will be situated upstream of the point Ps of the shoe, as illustrated in Figure 6. The angle α is set by moving the journalling axle of the shoe press roll in a path that is concentric with the envelope surface of the counter roll, after which the shoe press roll is fixed, when the angle α has the desired value. At the desired value, which may vary depending on different operating conditions, the shoe is so concentrically displaced in relation to the point Pw where the forming wire 4 meets the counter roll at a tangent, that the forming wire 4 runs into the press nip without being bent around the curved inlet surface 35 of the shoe and, furthermore, without the web carried by the forming wire 4 coming into contact with the deflections the shoe belt is subjected to immediately prior to the press nip due to its change of direction and rigidity. It will be understood that the tangent Ts is always situated above the forming wire 4 (the tangent Tw), i.e. seen generally, is always on the same side of the forming wire 4 as the process belt 15. In accordance with a preferred embodiment said angle α is greater than 6°.

C L A I M S

1. A shoe press in a wire part of a board or paper machine for manufacturing a continuous web (10), which wire part comprises a headbox (3) and at least one forming wire (4) running in a loop, which shoe press comprises a shoe press roll (14), arranged outside the loop of the forming wire (4), a counter roll (13) arranged in the loop of the forming wire (4) and, together with the shoe press roll (14), forming an extended press nip, and an outer clothing (15) running in a loop outside the forming wire (4) through said press nip to carry and transfer the web (10) after the press nip to a subsequent press section (2), which shoe press roll (14) comprises a rotatably journalled, flexible shoe belt (31) and a press shoe (32) arranged on the inside of the shoe belt (31) and having a curved, convex inlet surface (35) and a concave press surface (34) for cooperation with the counter roll (13), the transition between the inlet surface (35) and the press surface (34) being in a point (Ps) intersected by a tangent (Ts) to the inlet surface (35), whereby the forming wire (4) encounters the counter roll (13) in a point (Pw) intersected by a tangent (Tw) to the curved envelope surface of the counter roll (13), which tangent (Tw) coincides with the draw of the forming wire (4) upstream of said point (Pw), and wherein the shoe press comprises at least one water-receiving member arranged in the loop of the forming wire (4) in connection to the press nip, and has water-receiving, uniformly distributed voids (22; 27) that are open at least in the direction of the side of the forming wire (4) not carrying the web, characterized in that the press shoe is so arranged in relation to said point (Pw) that said tangent (Ts) and said tangent (Tw) intersect each other at an acute angle α that is greater than 2°, preferably greater than 6°.

2. A shoe press as claimed in claim 1, characterized in that the water-receiving member consists of a non-compressible inner belt (20) running in a loop inside the loop of the forming wire (4) around the counter roll (13) and through the press nip.

3. A shoe press as claimed in claim 2, characterized in that the voids (22) in the belt (20) form an open volume substantially equivalent to or greater than the volume of water that is pressed out of the web in the press nip, and that the press comprises conditioning members (25, 26) arranged downstream of the press nip in the vicinity of the belt (20) to remove water received in the press nip, from said voids (22) in the belt (20).

4. A shoe press as claimed in claim 2 or 3, characterized in that the counter roll (13) has an unperforated envelope surface.

5. A shoe press as claimed in any one of claims 2-4, characterized in that the water-receiving belt (20) is impermeable, the voids (22) consisting of recesses in the shape of round holes and/or grooves uniformly distributed.

6. A shoe press as claimed in any one of claims 2-4, characterized in that the water-receiving belt (20) is permeable, the voids (22) consisting of through-openings.

7. A shoe press as claimed in claim 6, characterized in that the permeable belt (20) consists of an open wire, the woven threads (23, 24) of which define interspaces that constitute said voids (22).

8. A shoe press as claimed in claim 2 in combination with claim 6 or 7, characterized in that it comprises a second water-receiving member in the form of said counter

roll (13), which is an open counter roll, the shell of which has water-receiving, evenly distributed voids (27) that are open at least outwardly, and in that the voids (22) of the belt (20) and the voids (27) of the counter roll (13) together have an aggregate open volume that is substantially equal to or greater than the volume of water pressed out of the web in the press nip.

9. A shoe press as claimed in claim 8, characterized in that the counter roll (13) is a perforated counter roll, the voids (27) of which forming radial through-openings.

10. A shoe press as claimed in claim 8 or 9, characterized in that the voids (22) of the belt (20) constitute at least 50%, preferably at least 60%, of said aggregate open volume.

11. A shoe press as claimed in any one of claims 2-10, characterized in that the water-receiving, inner belt (20) is arranged to meet the forming wire (4) at the inlet to the press nip or shortly before the press nip, where the belt (20) runs in contact with the counter roll (13).

12. A shoe press as claimed in any one of claims 2-10, characterized in that the water-receiving, inner belt (20) is arranged to meet the forming wire at a point located at a pre-determined distance from the press nip, before the belt (20) runs in contact with the counter roll (13).

13. A shoe press as claimed in any one of claims 1-12, characterized in that said outer clothing (15) is a substantially impermeable belt arranged to carry the web (10) from said press nip to the subsequent press section (2).

14. A shoe press as claimed in any one of claims 1-13, characterized in that said wire part is a fourdrinier former.

15. A shoe press as claimed in claim 1, characterized in that water-receiving member consists of said counter roll (13) which is an open counter roll, the shell of which is provided with water-receiving, uniformly distributed voids (27) that are open at least outwardly.

16. A shoe press as claimed in claim 15, characterized in that the counter roll (13) is a perforated counter roll, the voids (27) of which forming radial through-openings.

17. A wire part of a board or paper machine for manufacturing a continuous web (10), which wire part comprises a headbox (3), at least one forming wire (4) running in a loop, and one or more presses, at least one of which is a shoe press, which shoe press comprises a shoe press roll (14) arranged outside the loop of the forming wire (4), a counter roll (13) arranged in the loop of the forming wire (4) and, together with the shoe press roll (14), forming an extended press nip, and an outer clothing (15) running in a loop outside the forming wire (4) through said press nip to carry and transfer the web (10) after the press nip to a subsequent press section (2), which shoe press roll (14) comprises a rotatably journalled, flexible shoe belt (31) and a press shoe (32) arranged on the inside of the shoe belt (31) and having a curved, convex inlet surface (35) and a concave press surface (34) for cooperation with the counter roll (13), the transition between the inlet surface (35) and the press surface (34) being in a point (Ps) intersected by a tangent (Ts) to the inlet surface (35), whereby the forming wire (4) encounters the counter roll (13) in a point (Pw) intersected by a tangent (Tw)

to the curved envelope surface of the counter roll (13), which tangent (Tw) coincides with the draw of the forming wire (4) upstream of said point (Pw), and wherein the shoe press comprises at least one water-receiving member arranged in the loop of the forming wire (4) in connection to the press nip, and has water-receiving, uniformly distributed voids (22; 27) that are open at least in the direction of the side of the forming wire (4) not carrying the web, characterized in that the press shoe is so arranged in relation to said point (Pw) that said tangent (Ts) and said tangent (Tw) intersect each other at an acute angle α that is greater than 2°, preferably greater than 6°.

18. A wire part as claimed in claim 17, characterized in that the water-receiving member consists of a non-compressible, inner belt (20) running in a loop inside the loop of the forming wire (4) around the counter roll (13) and through the press nip.

19. A wire part as claimed in claim 18, characterized in that the voids (22) in the belt (20) form an open volume substantially equivalent to or greater than the volume of water that is pressed out of the web in the press nip, and that the press comprises conditioning members (25, 26) arranged downstream of the press nip in the vicinity of the belt (20) to remove water received in the press nip, from said voids (22) in the belt (20).

20. A wire part as claimed in claim 18 or 19, characterized in that the counter roll (13) has an unperforated envelope surface.

21. A wire part as claimed in any one of claims 18-20, characterized in that the water-receiving belt (20) is impermeable, the voids (22) consisting of recesses in the shape of round holes and/or grooves, evenly distributed.

22. A wire part as claimed in any one of claims 18-20, characterized in that the water-receiving belt (20) is permeable, the voids (22) consisting of through-openings.

23. A wire part as claimed in claim 22, characterized in that the permeable belt (20) consists of an open wire, the woven threads (23, 24) of which define interspaces that constitute said voids (22).

24. A wire part as claimed in claim 18 in combination with claim 22 or 23, characterized in that it comprises a second water-receiving member in the form of said counter roll (13), which is an open counter roll, the shell of which has water-receiving, evenly distributed voids (27) that are open at least outwardly, and in that the voids (22) of the belt (20) and the voids (27) of the counter roll (13) together have an aggregate open volume that is substantially equal to or greater than the volume of water pressed out of the web in the press nip.

25. A wire part as claimed in claim 24, characterized in that the counter roll (13) is a perforated counter roll, the voids (27) of which forming radial through-openings.

26. A wire part as claimed in claim 24 or 25, characterized in that the voids (22) of the belt (20) constitute at least 50%, preferably at least 60%, of said aggregate open volume.

27. A wire part as claimed in any one of claims 18-26, characterized in that the water-receiving, inner belt (20) is arranged to meet the forming wire (4) at the inlet to the press nip or shortly before the press nip, where the belt (20) runs in contact with the counter roll (13).

28. A wire part as claimed in any one of claims 18-26, characterized in that the water-receiving, inner belt (20) is arranged to meet the forming wire at a point located at a pre-determined distance from the press nip, before the belt (20) runs in contact with the counter roll (13).

29. A wire part as claimed in any one of claims 17-28, characterized in that the outer clothing (15) is a substantially impermeable belt arranged to carry the web (10) from said press nip to the subsequent press section (2).

30. A wire part as claimed in any one of claims 17-29, characterized in that it is a fourdrinier former.

31. A wire part as claimed in claim 17, characterized in that the water-receiving member consists of said counter roll (13), which is an open counter roll, the shell of which is provided with water-receiving, uniformly distributed voids (27) that are open at least outwardly.

32. A wire part as claimed in claim 31, characterized in that the counter roll (13) is a perforated counter roll, the voids (27) of which forming radial through-openings.

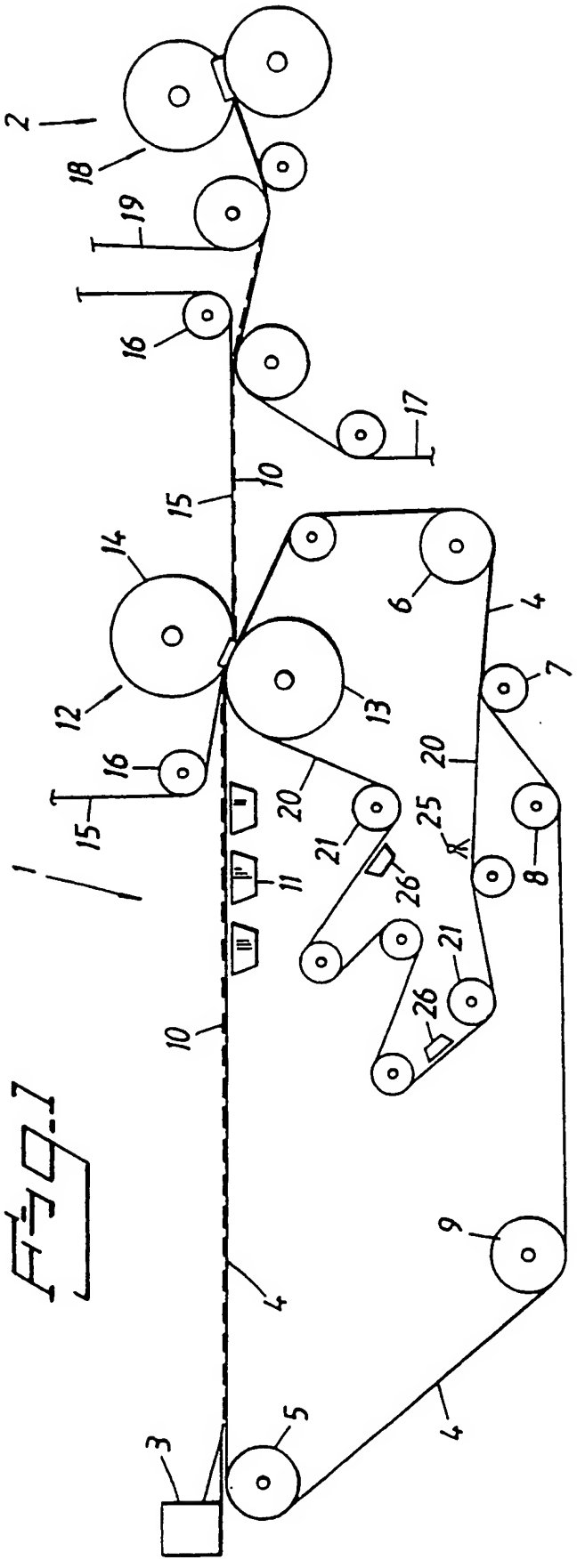


Fig. 1

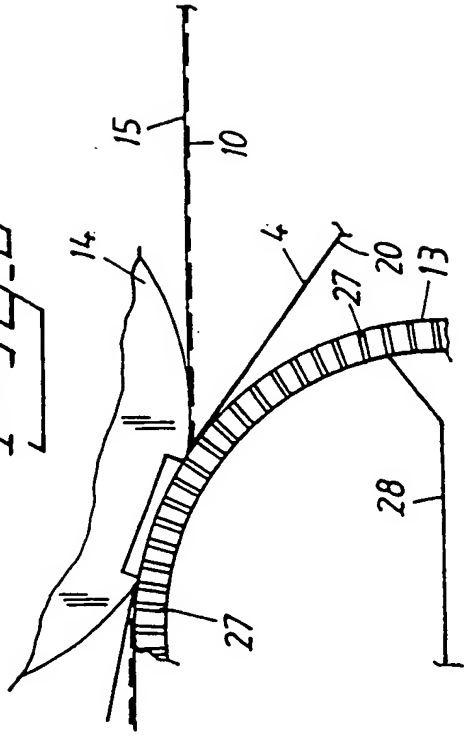


Fig. 3

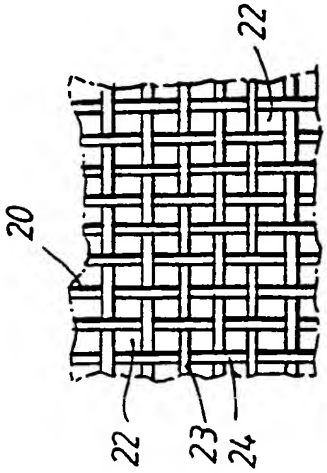


Fig. 2

Fig. 4

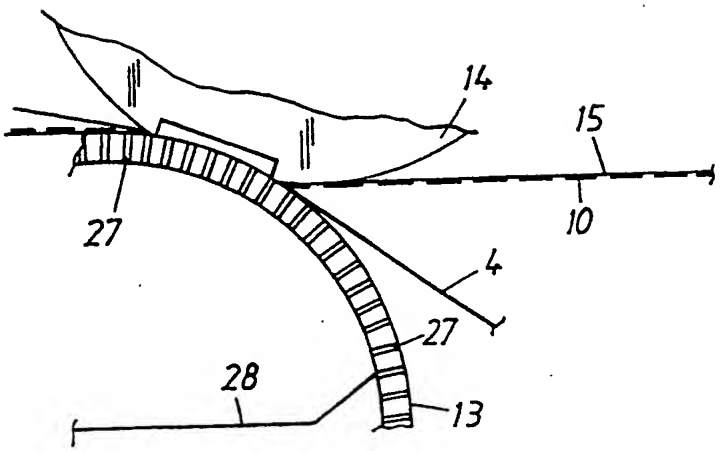
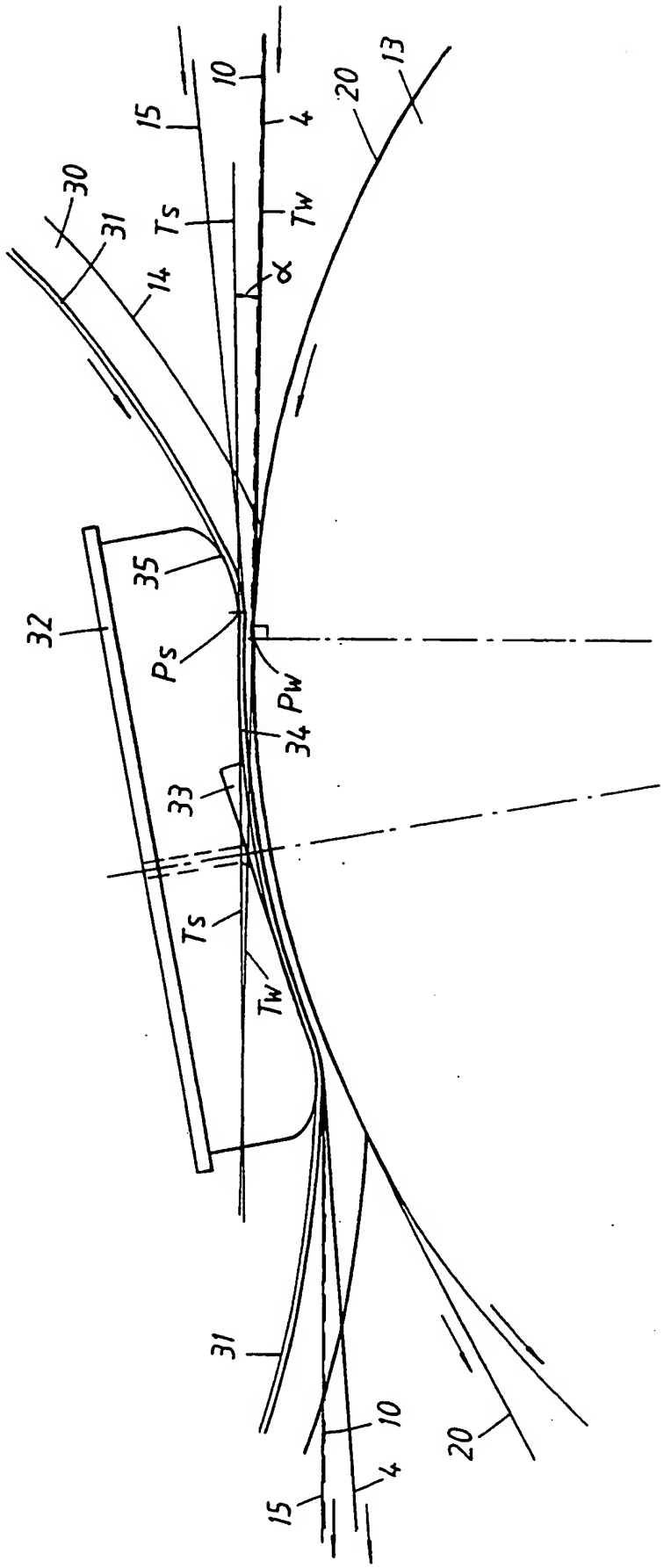


Fig.5



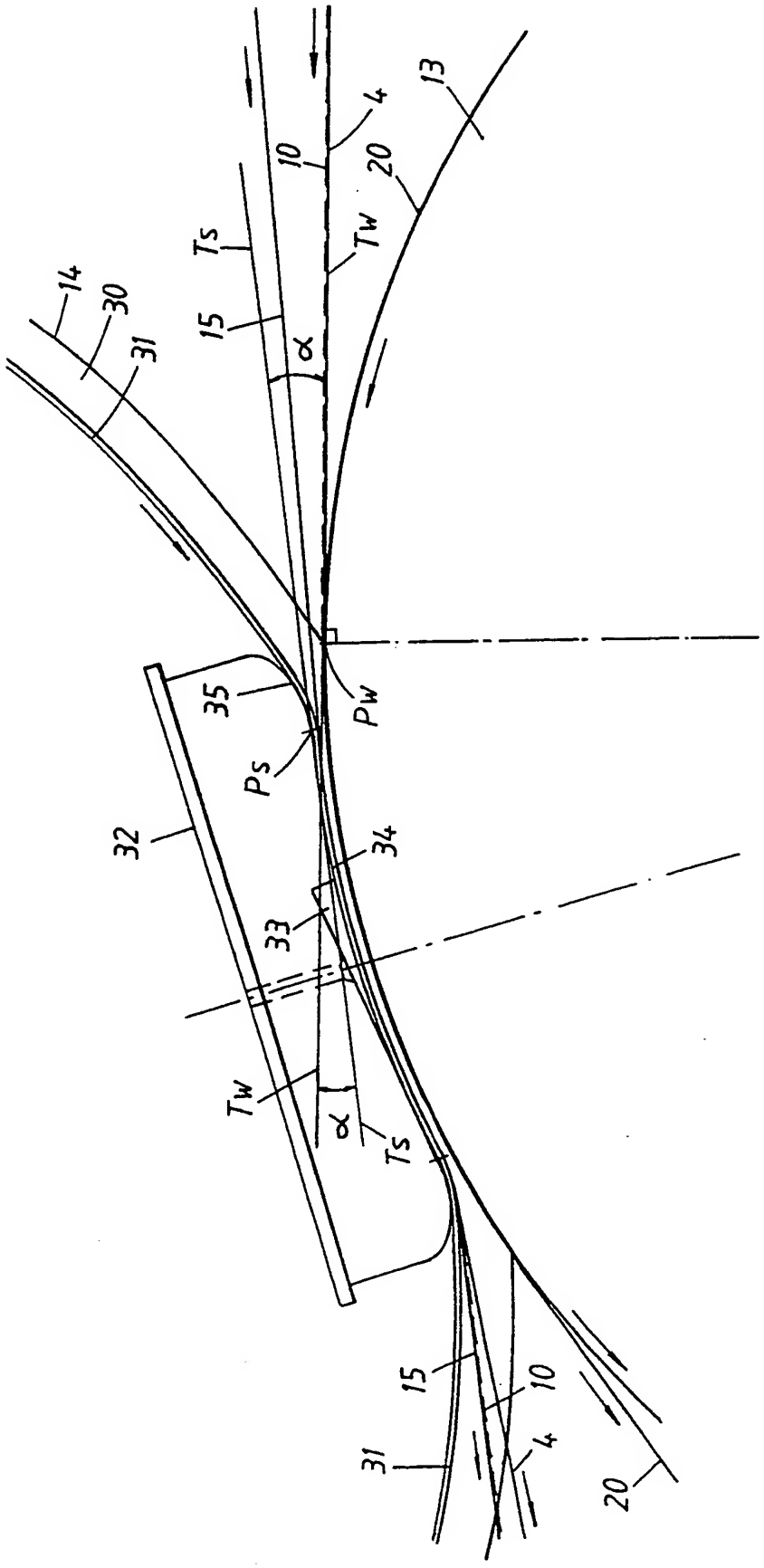


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 99/02228

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: D21F 3/02
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: D21F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DIALOG: ALLSCIENCE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CA 2218201 A1 (MESCHENMOSER, ANDREAS), 14 April 1998 (14.04.98), page 11, line 9 - line 14, figure 1	1,17
E,A	WO 9919562 A1 (VALMET CORPORATION), 22 April 1999 (22.04.99)	1,17

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 March 2000	18 -04- 2000
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Olov Jensén/ELY

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/SE 99/02228

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CA 2218201 A1	14/04/98	DE 19642401 A	16/04/98
		EP 0837183 A	22/04/98
		JP 10131077 A	19/05/98
WO 9919562 A1	22/04/99	SE 511203 C	23/08/99
		SE 9703766 A	15/04/99

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

CORRECTED VERSION

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
15 June 2000 (15.06.2000)

PCT

(10) International Publication Number
WO 00/34570 A1

(51) International Patent Classification[7]: D21F 3/02

(21) International Application Number: PCT/SE99/02228

(22) International Filing Date:
30 November 1999 (30.11.1999)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
9804231-0 7 December 1998 (07.12.1998) SE
9903694-9 14 October 1999 (14.10.1999) SE

(71) Applicant *(for all designated States except US)*: VALMET-KARLSTAD AB [SE/SE]; Box 1014, S-651 15 Karlstad (SE).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: LEANDERSSON, Per, Anders, Artur [SE/SE]; Kvarnbergsgatan 6, S-652 29 Karlstad (SE). SALOMONSSON, Carl-Gustaf [SE/SE]; Prästbolsvägen 8, S-66594 Fagerås (SE).

(74) Agent: LUNDQUIST, Lars-Olof; L-O Lundquist Patentbyrå AB, P.O. Box 80, S-651 03 Karlstad (SE).

(81) Designated States *(national)*: BR, CA, JP, KR, US.

(84) Designated States *(regional)*: European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

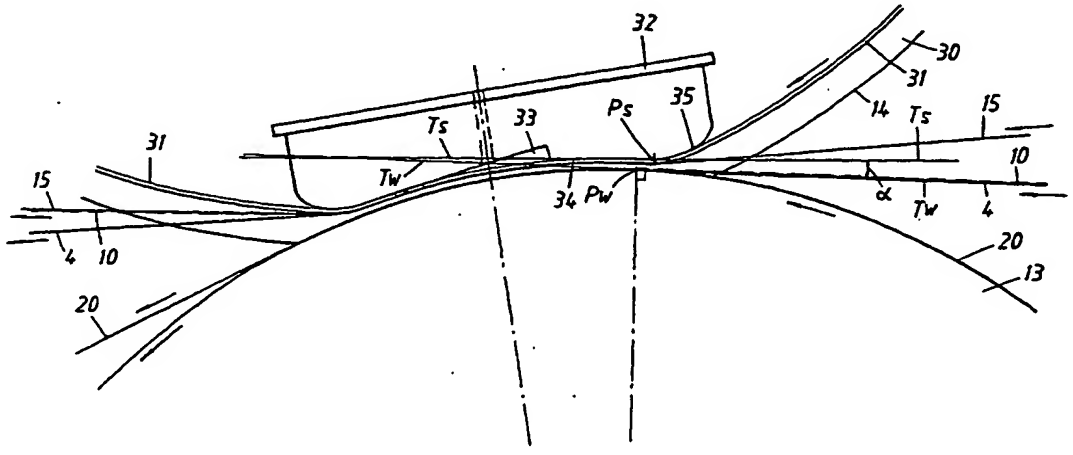
Published:
— *With international search report.*

(48) Date of publication of this corrected version:
25 May 2001

(15) Information about Correction:
see PCT Gazette No. 21/2001 of 25 May 2001, Section II

[Continued on next page]

(54) Title: SHOE PRESS IN A WIRE PART OF A BOARD OR PAPER MACHINE AND A WIRE PART



(57) Abstract: A shoe press in a wire part with headbox and forming wire (4), which shoe press comprises a shoe press roll (14) outside and a counter roll (13) inside the loop of the forming wire, and an outer clothing (15) running outside the forming wire to transfer the web (10) after the extended press nip to a press section, which shoe press roll has a press shoe (32) with a curved, convex inlet surface (35) and a concave press surface (34) into which the inlet surface transits in a point (Ps) intersected by a tangent (Ts) to the inlet surface, whereby the forming wire encounters the counter roll in a point (Pw) intersected by a tangent (Tw) to the counter roll, and wherein the shoe press has an inner belt (20) running in the loop of the forming wire and having water-receiving voids that are open towards the forming wire. In accordance with the invention the press shoe is so arranged in relation to said point (Pw) that said tangent (Ts) and said tangent (Tw) intersect each other at an acute angle α that is greater than 2°. The invention also relates to a wire part having such a shoe press.

WO 00/34570 A1

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.